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LENGTH-WEIGHT RELATION IN THE COMMON OR WHITE SHRIMP *PENAEUS SETIFERUS*

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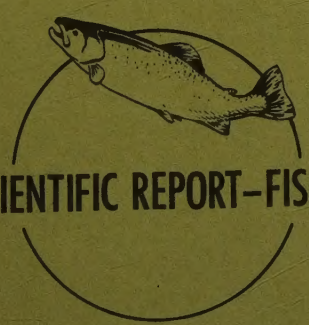

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EXPLANATORY NOTE

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United States Department of the Interior, Fred A. Seaton, Secretary
Fish and Wildlife Service, Arnie J. Suomela, Commissioner

LENGTH-WEIGHT RELATION IN THE COMMON OR WHITE SHRIMP, PENAEUS SETIFERUS

by

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LENGTH-WEIGHT RELATION IN THE COMMON OR WHITE SHRIMP, PENAEUS SETIFERUS

In order to determine the size at which a species can be most profitably taken, the relation between increase in mass weight of a shrimp population through growth and recruitment and decrease through mortality must be known. Information about length and weight as attributes of growth are essential in understanding this relation. The length-weight relations for common or white shrimp, Penaeus setiferus (Linnaeus), were determined from measurements of lengths and weights of 14,284 specimens secured over a 1-year period in Texas. Material was obtained during each month of the year. Measurements of total length (from tip of rostrum to tip of telson) were taken to the nearest millimeter and weights to the nearest tenth of a gram. Table 1 presents the monthly length-weight distributions showing separately for males and females the number of specimens examined in each 5-mm. length interval and the average weight in grams.

Some differences in the length-weight relation occur seasonally owing primarily to changes in the body proportions of the shrimp. The bodies of the older shrimp tend to thicken, and their weights are greater in proportion to length than are those of younger shrimp. This change appears to be associated with maturity and was most noticeable during July and August when both mature shrimp, about 1 year old, and immature young-of-the-year were present in the catches in appreciable numbers. The differences in weight for mature and immature shrimp of the same length are shown in table 2 and figure 1. Where the two length ranges overlap (148 to 163 mm.) it is readily apparent that the mature shrimp average considerably heavier (about 3 grams) than immature shrimp of the same length.

In figure 1 we have also plotted the length-weight relation of all shrimp over 100 mm. total length taken during the period of September through March (table 3). These shrimp were largely immature. The length-weight relation for these shrimp from September to March was identical with that of the immature for July-August over the overlapping size ranges (103 to 163 mm.). In shrimp over 170 mm. total length the difference between the upper and lower curves decreases, and it disappears entirely between about 180 and 190 mm. We interpret this to mean that all shrimp over 190 mm. total length were mature and that between 170 and 190 mm. there were increasing proportions of mature or maturing shrimp.

The general practice in the shrimp industry is to refer to the size of shrimp in terms of the number required to make 1 pound. Two systems are in use--the number of whole shrimp per pound and the number of shrimp tails per pound. The latter is more generally used. Since the original measurements were made for whole shrimp, the factor 1.68 has been applied to the number of whole shrimp per pound to obtain the approximate number of tails per pound. These data are presented in table 4 and in figure 2 and 3. Most of the commercial catch of white shrimp is composed of shrimp between 3 and 8 inches in total length.

Kenneth H. Mosher contributed much in the collection of data which made this study possible.

Table 1.--Seasonal length-weight distribution for Texas shrimp
(weights in grams)

Midpoint of length interval (mm.)	January				February			
	Males		Females		Males		Females	
	Number	Average weight	Number	Average weight	Number	Average weight	Number	Average weight
18								
23								
28								
33								
38								
43								
48								
53								
58								
63								
68								
73								
78	1	3.00						
83	2	4.00	2	4.00				
88			4	5.00	1	5.00		
93	7	5.29	7	5.71	1	5.00		
98	17	6.71	11	6.55				
103	24	7.71	24	7.46	1	8.00		
108	26	8.58	32	8.53	4	9.50	3	9.00
113	22	10.09	32	9.97	8	10.75	6	11.17
118	13	12.54	23	11.87	12	12.50	11	12.82
123	26	14.15	20	14.20	28	14.71	29	14.31
128	39	15.77	28	15.89	46	16.41	52	16.08
133	19	18.21	23	17.87	71	17.89	71	17.86
138	16	19.88	18	19.67	61	20.03	69	19.87
143	12	22.00	9	22.44	60	22.70	58	22.28
148	5	25.00	5	25.60	56	25.38	51	25.06
153	3	29.00	1	26.00	37	28.43	28	28.18
158	7	31.43	3	33.33	38	31.11	28	31.29
163	4	34.00	4	35.25	25	34.20	15	34.53
168	3	38.00	3	39.67	5	39.20	17	37.82
173			3	40.67	1	44.00	3	40.00
178			1	47.00	2	44.50	1	55.00
183			1	46.00			1	55.00
Total	246		254		457		443	

Table 1.--Seasonal length-weight distribution for Texas shrimp, cont'd

Midpoint of length interval (mm.)	March				April			
	Males		Females		Males		Females	
	Number	Average weight	Number	Average weight	Number	Average weight	Number	Average weight
18								
23								
28								
33								
38								
43								
48								
53								
58								
63								
68								
73								
78								
83								
88	1	5.00						
93								
98	1	7.00	1	8.00			1	9.00
103			1	8.00				
108			1	9.00			2	9.50
113	13	10.23	5	10.80	1	11.00	2	11.00
118	5	12.80	9	12.22	1	13.00	14	13.71
123	12	14.00	16	13.56	9	15.22	18	15.28
128	16	15.75	6	15.50	58	17.09	28	17.21
133	5	17.40	6	17.33	93	18.98	67	18.67
138	7	20.29	4	19.50	135	20.92	90	20.90
143	6	22.33	2	22.50	113	23.50	97	23.74
148	6	26.00	3	24.67	75	26.37	104	26.12
153	4	28.75	6	28.83	36	29.42	68	29.01
158	39	32.74	11	31.82	30	32.20	52	32.02
163	24	35.04	18	35.89	16	35.38	27	35.48
168	18	38.39	28	37.75	11	39.00	23	39.17
173	3	41.33	13	42.46	4	44.50	15	42.67
178			6	46.17	1	49.00	3	48.33
183			2	49.00			2	53.00
188			1	50.00				
Total	160		139		583		613	

Table 1.--Seasonal length-weight distribution for Texas shrimp, cont'd

Midpoint of length interval (mm.)	May				June			
	Males		Females		Males		Females	
	Number	Average weight	Number	Average weight	Number	Average weight	Number	Average weight
18							1	0.10
23							8	0.11
28							11	0.19
33					2	0.3	18	0.30
38					2	0.6	18	0.49
43					2	0.7	2	0.65
48					1	0.9	2	0.90
53					2	1.0	3	0.97
58							1	1.20
63								
68								
73								
78								
83								
88								
93								
98								
103								
108								
113	1	12.00	1	11.00				
118			2	12.50				
123	2	16.00						
128	3	15.67	3	18.00				
133	4	19.50	3	19.00				
138	27	21.81	7	21.29	1	24.00		
143	45	24.38	19	24.32	4	25.75		
148	115	27.37	51	27.10	42	28.33	4	27.00
153	246	29.76	101	29.51	98	31.01	14	30.07
158	239	32.50	144	32.08	151	34.12	46	33.30
163	130	35.37	164	36.01	136	37.09	76	36.83
168	48	38.44	203	38.93	79	40.25	109	39.95
173	18	41.83	146	42.79	14	45.21	129	44.16
178	4	44.50	50	46.84	2	48.50	79	48.27
183			15	50.27			44	52.70
188			2	54.50			10	58.00
193			2	59.50			3	60.33
198			1	70.00				
Total	882		914		536		578	

Table 1.--Seasonal length-weight distribution for Texas shrimp, cont'd

Midpoint of length interval (mm.)	July				August			
	Males		Females		Males		Females	
	Number	Average weight	Number	Average weight	Number	Average weight	Number	Average weight
18			8	0.10				
23			14	0.10			1	0.10
28			14	0.15			6	0.23
33			16	0.30	2	0.50	5	0.36
38			19	0.51	1	0.60	7	0.47
43	1	0.6	11	0.64			3	0.97
48			22	0.86	1	1.00	3	1.00
53	5	1.30	16	1.21	1	1.40		
58	3	1.53	9	1.66			1	2.00
63	1	1.80	4	2.03				
68	1	2.50	5	2.50				
73	1	3.00	2	3.00				
78	5	3.84	7	3.89				
83	5	4.34	4	4.93			2	5.00
88	3	5.50	6	5.47			2	4.50
93	5	6.80	8	6.00	2	5.50	8	6.00
98	12	7.08	5	7.20	9	7.44	9	7.22
103	14	8.14	15	8.07	20	8.15	16	8.19
108	10	9.30	13	9.08	14	9.14	19	8.95
113	14	11.00	9	10.67	31	10.94	27	10.52
118	12	12.42	12	12.83	27	12.19	38	12.13
123	8	13.75	3	15.00	47	13.55	49	13.78
128	12	16.17	5	15.20	63	15.59	55	15.60
133	6	18.17	6	17.67	77	17.75	52	17.75
138	4	20.50	5	20.00	95	19.69	90	19.57
143	4	23.50	6	23.00	64	22.22	71	22.10
148	5	27.20	7	26.57	50	24.74	37	25.24
153	32	31.09	10	29.70	32	27.50	37	27.30
158	121	34.45	19	33.32	24	34.63	20	31.20
163	171	37.32	53	37.23	42	38.38	14	34.57
168	72	40.64	98	40.61	28	42.07	23	41.04
173	24	43.67	86	44.76	8	46.00	33	45.18
178	5	48.00	54	48.28	3	48.00	32	49.41
183			32	52.63			14	53.64
188			8	56.75			11	56.91
193			2	59.00			1	62.00
198			2	70.00				
Total	556		615		641		686	

Table 1.--Seasonal length-weight distribution for Texas shrimp, cont'd

Midpoint of length interval (mm.)	September				October			
	Males		Females		Males		Females	
	Number	Average weight	Number	Average weight	Number	Average weight	Number	Average weight
18								
23								
28								
33								
38								
43								
48							1	1.00
53								
58	1	2.00	3	1.33			1	1.00
63							1	2.00
68	2	2.50					1	3.00
73	1	3.00	2	3.00	1	3.14	2	3.00
78	1	3.00	5	3.40	5	2.60		
83	3	4.33	3	4.33	2	4.50	6	3.67
88	4	5.00	6	5.00	3	5.00	8	5.00
93	8	5.75	12	6.00	5	5.80	8	6.50
98	18	7.06	13	6.92	3	7.00	4	7.25
103	33	7.91	31	7.90	14	8.07	7	7.86
108	50	9.26	42	9.24	28	9.64	17	9.00
113	89	11.00	58	10.76	36	10.69	29	10.62
118	92	12.25	76	12.08	53	11.92	42	11.83
123	100	13.92	92	13.68	76	13.92	62	13.89
128	86	15.81	74	15.73	96	15.84	83	15.81
133	72	18.00	79	17.75	110	17.82	115	17.60
138	77	19.90	76	19.93	107	19.53	104	19.77
143	68	22.43	47	22.40	75	22.19	102	22.18
148	73	25.34	50	25.18	50	24.90	62	24.97
153	38	27.37	44	27.61	21	28.43	42	28.12
158	10	30.90	21	30.81	14	32.71	37	31.46
163	7	33.57	16	34.50	8	35.50	9	34.56
168	2	36.00	5	37.80	7	39.86	17	37.71
173			4	41.50	3	43.33	6	49.17
178			3	47.00			7	50.57
183			1	50.00			4	50.25
Total	835		763		717		777	

Table 1.--Seasonal length-weight distribution for Texas shrimp, cont'd

Midpoint of length interval (mm.)	November				December			
	Males		Females		Males		Females	
	Number	Average weight	Number	Average weight	Number	Average weight	Number	Average weight
18								
23								
28								
33								
38								
43								
48								
53	1	2.00						
58			1	2.00				
63								
68	1	2.00						
73	1	3.00	2	3.50				
78	1	3.00			2	4.00	1	4.00
83	2	4.00	1	4.00	6	4.83	7	4.43
88	4	5.25	6	4.67	5	4.80	15	5.00
93	9	6.11	9	6.33	22	6.23	25	5.72
98	28	6.96	20	7.15	26	7.08	27	6.81
103	33	8.06	36	8.06	37	8.03	44	8.11
108	43	9.23	45	9.16	55	9.27	49	8.98
113	59	10.76	71	10.61	58	10.47	62	10.56
118	55	12.00	74	12.14	51	12.10	57	12.07
123	48	13.98	62	13.58	47	13.66	61	13.57
128	53	15.83	67	15.63	43	15.56	49	15.92
133	50	17.72	66	17.53	51	17.71	61	17.44
138	57	19.65	73	19.52	77	19.61	61	19.77
143	39	22.13	57	22.18	58	22.21	68	22.12
148	29	24.38	38	25.21	90	25.13	81	24.74
153	15	27.53	39	27.90	64	28.20	43	28.05
158	17	30.94	18	31.67	59	30.93	42	30.36
163	10	34.00	15	35.13	22	33.77	25	33.96
168	4	37.25	24	38.79	13	39.23	12	38.58
173			8	42.88	3	42.67	7	43.57
178			5	45.40	1	48.00	3	50.67
183							1	52.00
188								
193			1	62.00			1	62.00
Total	559		738		790		802	

Table 2.--Length-weight distributions for mature and immature Texas shrimp for July and August, both sexes included, weights in grams

Midpoint of length interval (mm.)	Immature			Mature		
	Number	Total weight	Average weight	Number	Total weight	Average weight
18	8	0.8	0.10			
23	15	1.5	0.10			
28	20	3.5	0.18			
33	23	7.6	0.33			
38	27	13.5	0.60			
43	15	10.5	0.70			
48	26	22.9	0.88			
53	22	27.2	1.24			
58	13	21.5	1.65			
63	5	9.9	1.98			
68	6	15.0	2.50			
73	3	9.0	3.00			
78	12	46.4	3.87			
83	11	51.4	4.67			
88	11	58.3	5.30			
93	23	140.0	6.09			
98	35	253.0	7.23			
103	65	529.0	8.14			
108	56	509.0	9.09			
113	81	873.0	10.78			
118	89	1093.0	12.28			
123	107	1467.0	13.71			
128	135	2110.0	15.63			
133	141	2505.0	17.77			
138	194	3814.0	19.66			
143	145	3223.0	22.23			
148	92	2307.0	25.08	7	186.0	26.57
153	69	1890.0	27.39	42	1292.0	30.76
158	20	624.0	31.20	164	5632.0	34.34
163	14	484.0	34.57	266	9967.0	37.47
168				221	9028.0	40.85
173				151	6756.0	44.74
178				94	4572.0	48.64
183				46	2435.0	52.93
188				19	1080.0	56.84
193				3	180.0	60.00
198				2	140.0	70.00
Total	1483			1015		

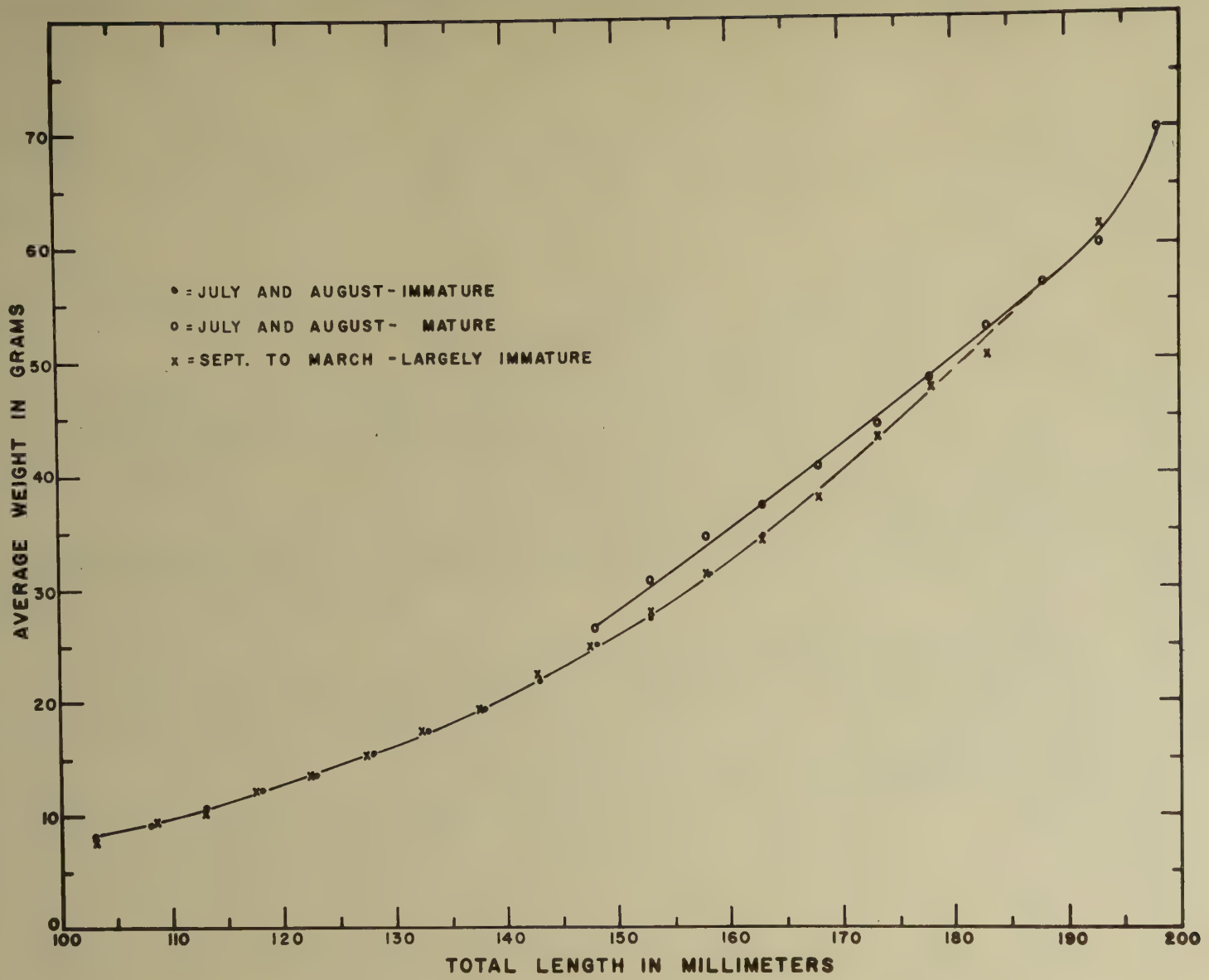

Figure 1.--Comparison of the length-weight relation between mature and immature specimens.

Table 3.--Length-weight distribution for Texas shrimp (103 mm. and larger) for September to March inclusive, both sexes included

Midpoint of length interval (mm.)	Number	Total weight in grams	Average weight in grams
103	285	2,264	7.94
108	395	3,603	9.12
113	548	5,827	10.63
118	573	6,938	12.11
123	679	9,417	13.87
128	738	11,688	15.84
133	799	14,178	17.74
138	807	15,939	19.75
143	661	14,722	22.27
148	599	15,015	25.07
153	385	10,787	28.02
158	344	10,779	31.33
163	202	6,978	34.54
168	158	6,054	38.32
173	54	2,329	43.13
178	29	1,390	47.93
183	10	502	50.20
188	1	50	50.00
193	2	124	62.00
Total	7269		

Table 4.--Length-weight distribution for Texas shrimp, sexes combined and data for all months included. (Approximate number of tails per pound was computed by applying the factor of 1.68 to the number of shrimp per pound)

Midpoint of length interval (mm.)	Number	Total weight in grams	Average weight in grams	Number per pound	Approx. number tails per pound
18	9	0.9	0.10	4535.9	
23	23	2.4	0.10	4535.9	
28	31	5.6	0.18	2519.9	
33	43	13.6	0.32	1417.5	
38	47	23.5	0.50	907.2	
43	19	13.2	0.69	657.4	
48	30	26.6	0.89	509.7	
53	28	34.1	1.22	371.8	
58	20	31.7	1.58	287.1	
63	6	11.9	1.98	229.1	
68	10	25.0	2.50	181.4	
73	12	41.0	3.42	132.6	
78	28	97.4	3.48	130.3	
83	45	196.4	4.36	104.0	174.7
88	68	341.3	5.02	90.4	151.9
93	136	813.0	5.98	75.9	127.5
98	205	1436.0	7.00	64.8	108.9
103	350	2793.0	7.98	56.8	95.4
108	453	4131.0	9.12	49.7	83.5
113	634	6756.0	10.66	42.6	71.6
118	679	8261.0	12.17	37.3	62.7
123	815	11328.0	13.90	32.6	54.8
128	965	15372.0	15.93	28.5	47.9
133	1107	19834.0	17.92	25.3	42.5
138	1261	25220.0	20.00	22.7	38.1
143	1084	24565.0	22.66	20.0	33.6
148	1089	28030.0	25.74	17.6	29.6
153	1059	30763.0	29.05	15.6	26.2
158	1190	38738.0	32.55	13.9	23.4
163	1031	37299.0	36.18	12.5	21.0
168	852	33694.0	39.55	11.5	19.3
173	531	23233.0	43.75	10.4	17.5
178	262	12586.0	48.04	9.4	15.8
183	117	6116.0	52.27	8.7	14.6
188	32	1819.0	56.84	8.0	13.4
193	10	604.0	60.40	7.5	12.6
198	3	210.0	70.00	6.5	10.9
Total	14284				

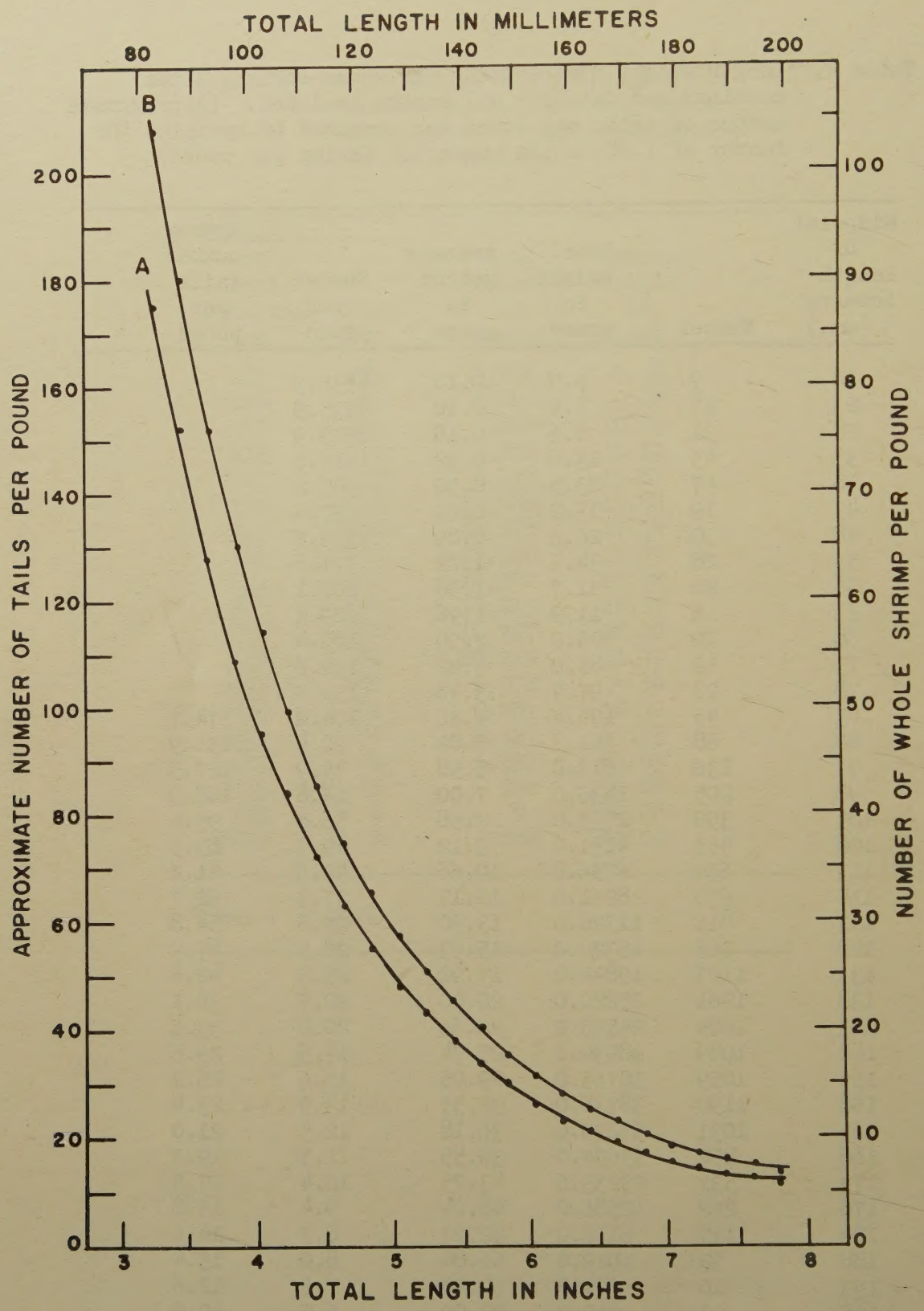

Figure 2.--Relation of the total length (in inches and millimeters) to number of whole shrimp (curve B) and approximate number of tails (curve A) per pound for shrimp about 3 to 8 inches long.

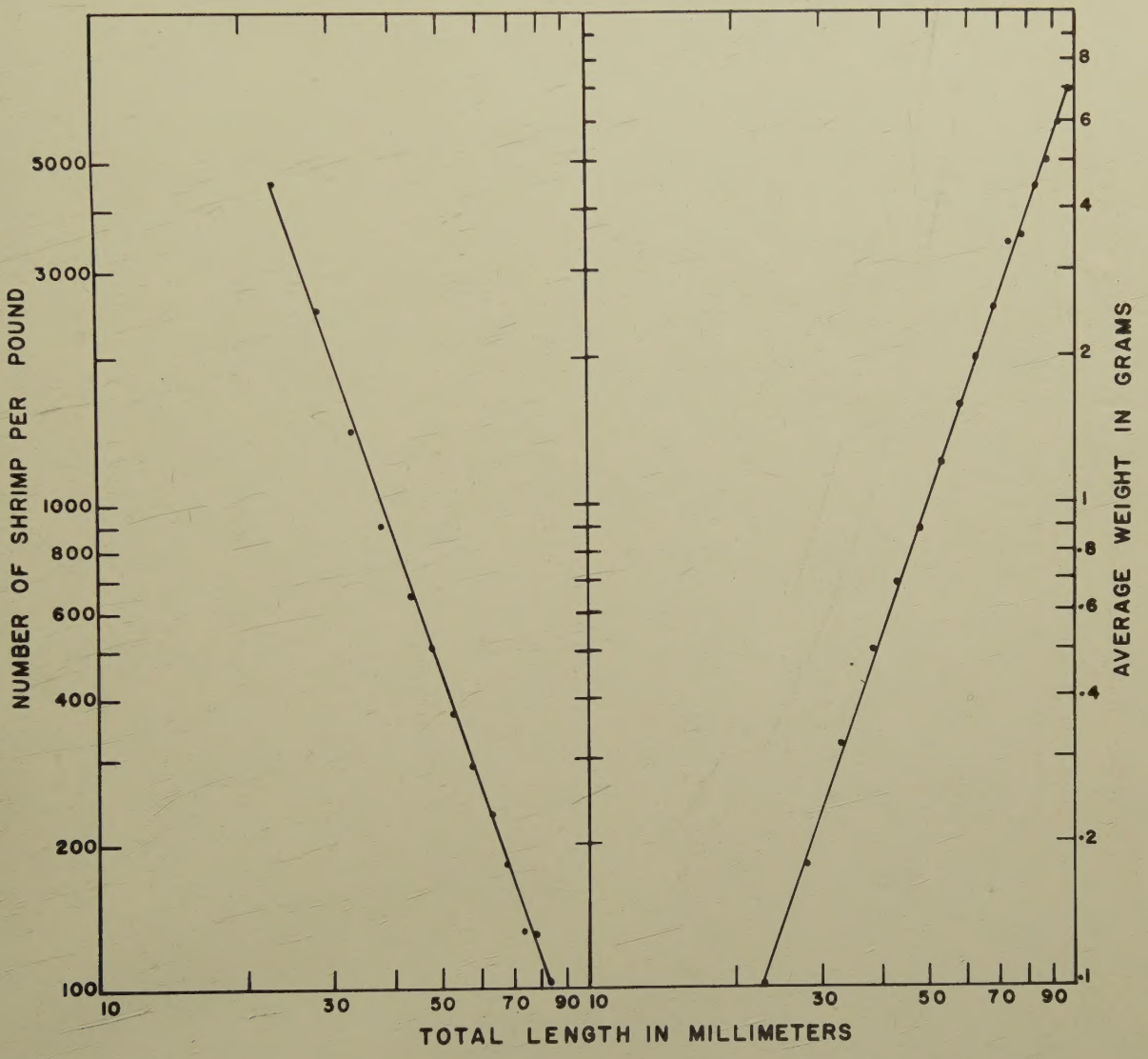

Figure 3.--Logarithmic relation of the total length in millimeters to number of shrimp per pound, and to weight in grams, for shrimp less than 100 mm. total length.

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